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7-013-17

State of residential energy consumption in Southeast Asia: need to promote smart appliances because urban household consumption is higher than some developed countries

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Waseda University

Overview of presentation

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- Survey method of house holed energy consumption
- Household energy consumption in Malaysia, Thailand, Vietnam and Cambodia
- CO_2 emission
- Characteristics of households and housing
- Home Appliances and Electronics
- Development of BELDA database
- Energy Efficiency Policy issues in Southeast Asian countries
- Conclusion and recommendations

Survey method of house holed energy consumption (2015)

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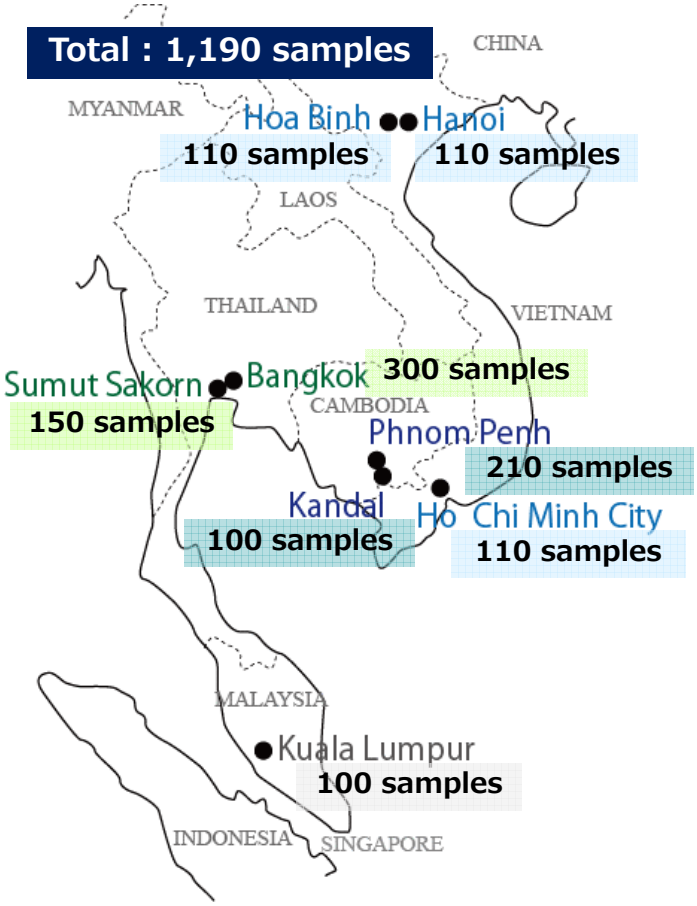

Survey Items

Identification of Household	number of household members, age, gender, occupation, the days that people usually at home during the daytime on weekdays, annual income of all family members
Housing Characteristics	building type, structure type of building, number of floors, gross floor area, established year, ownership, number of rooms
Energy Consumption and the Bills	monthly energy use by fuel type, monthly energy bills by fuel type
Home Appliances and Electronics	space cooling (room air-conditioning, fan, etc.), space heating (room air-conditioning, heaters, etc.), home appliances, lighting
Hot Water	type and number of water heating equipment, hours of use, bathing habits
Vehicles	type, number and frequency of use of automobiles and motorbikes/scooters
Lifestyle and Behaviour	ways of keeping home cool, satisfaction with the indoor environment, willingness to buy energy-efficient home appliances in the future and problems when buying energy-efficient home appliances, energy saving behaviours

Misunderstanding of the developed countries on household energy consumption in Southeast Asia

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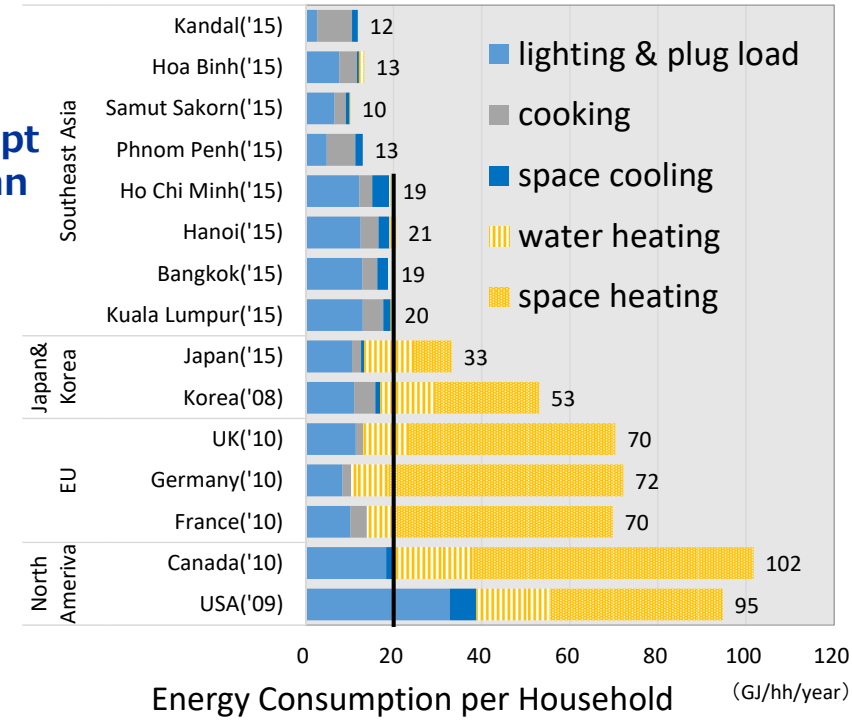
Household energy consumption in Southeast Asia is low.

Consumption in urban areas except for the heat demand is higher than some developed countries.

Cooking energy consumption is high because of remains large family system, high home proportion of noon.



Note) Source of data in Japan : "Pilot Survey, Survey on the Actual Conditions of Households for the Estimation of Carbon Dioxide Emissions" Ministry of Environment (Oct 2014 – Sep 2015)

Misunderstanding of the developed countries on household energy consumption in Southeast Asia

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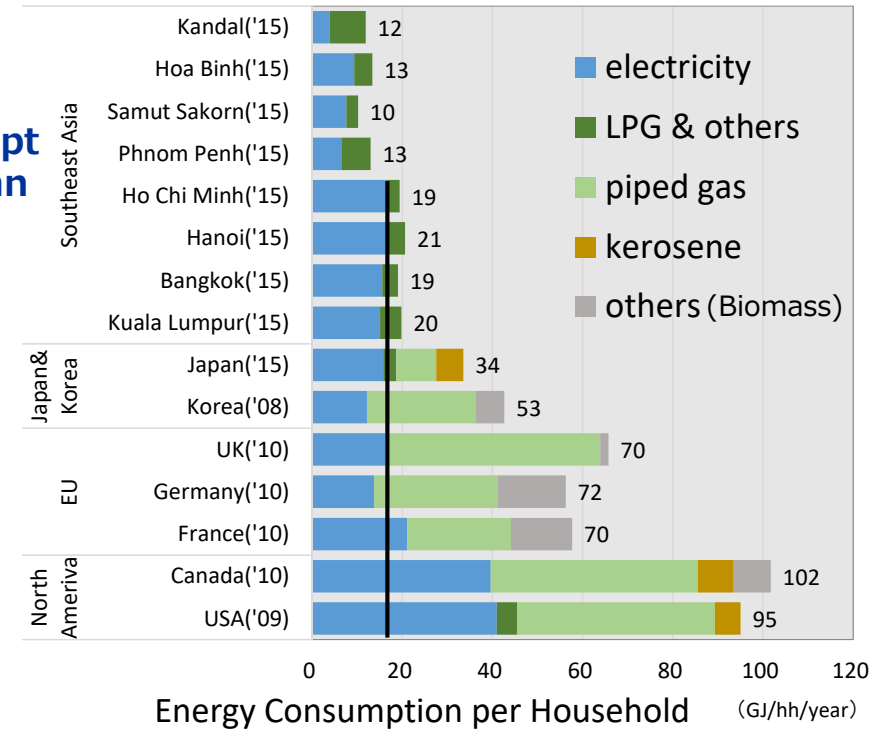
Household energy consumption in Southeast Asia is low.

Consumption in urban areas except for the heat demand is higher than some developed countries.

Cooking energy consumption is high because of remains large family system, high home proportion of noon.

Similarly, electricity consumption in urban areas is higher than some developed countries.

■ ***Energy efficiency improvement is urgent need to more than developed countries.***



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CO_2 emission

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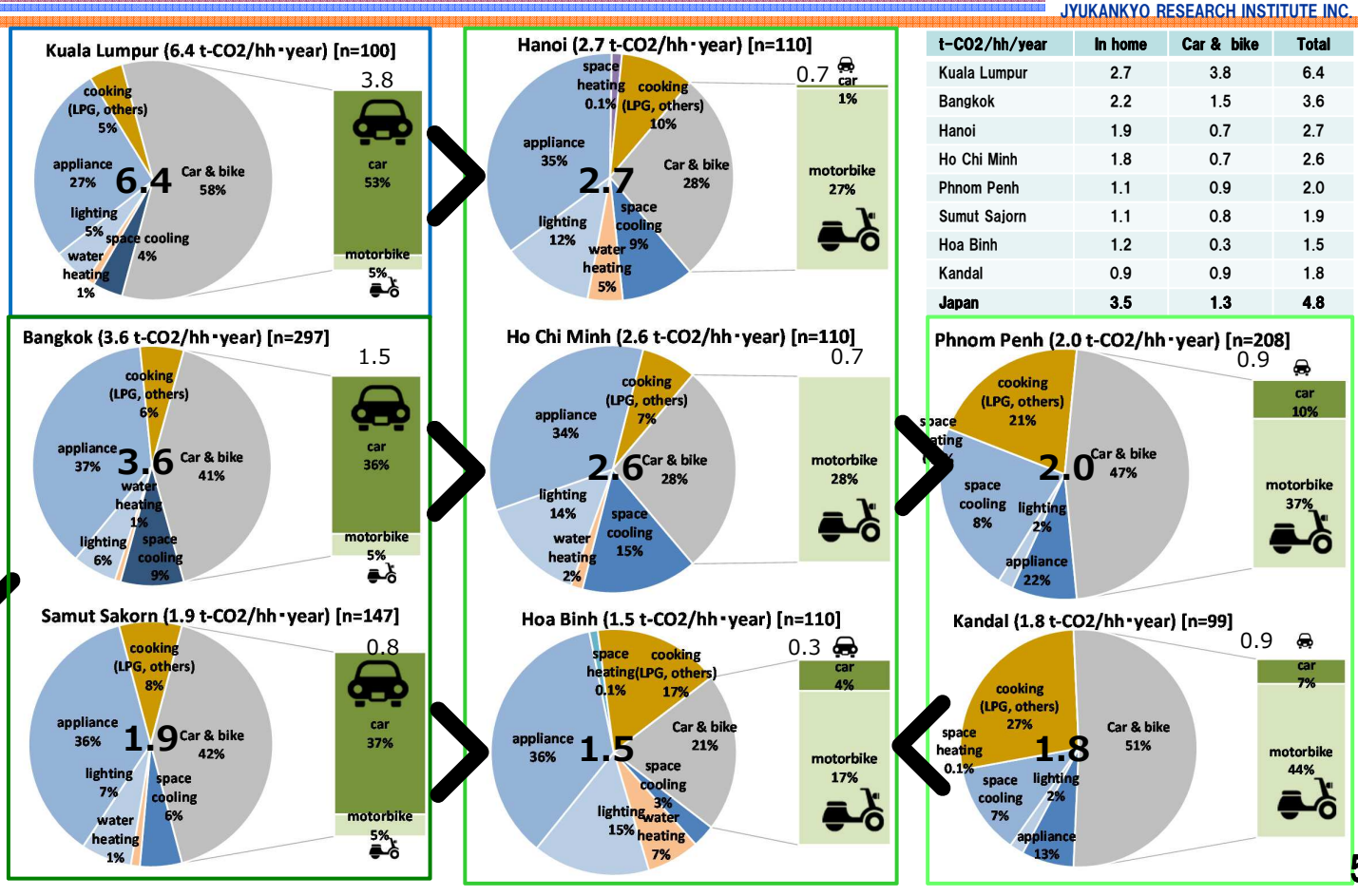
Urban area

Rural area



t-CO2/hh/year	In home	Car & bike	Total
Kuala Lumpur	2.7	3.8	6.4
Bangkok	2.2	1.5	3.6
Hanoi	1.9	0.7	2.7
Ho Chi Minh	1.8	0.7	2.6
Phnom Penh	1.1	0.9	2.0
Sumut Sajorn	1.1	0.8	1.9
Hoa Binh	1.2	0.3	1.5
Kandal	0.9	0.9	1.8
Japan	**3.5**	**1.3**	**4.8**

Characteristics of households and housing

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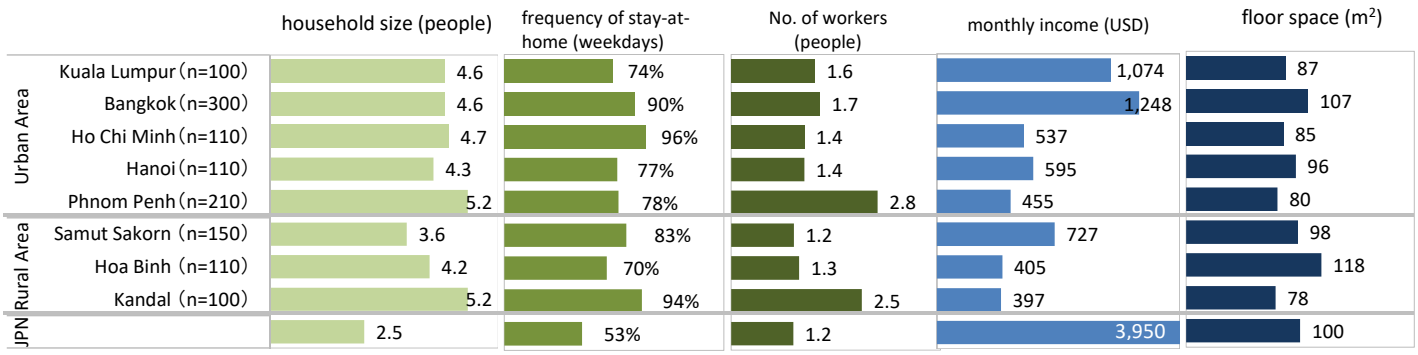
- Number of household members is 5/hh in urban area. Rural area is little smaller.
  - **There remains a large family system, three generations living together is more than 50% in urban areas except Kuala Lumpur.**
  - As a result, during the day on weekdays, someone is at home in most of them.
- Number of person with job: 2 or more in Cambodia,1.7 in Bangkok, 1.6 in Kuala Lumpur and less than 1.5 in Vietnam and Thailand except Bangkok
- Monthly income: Thailand > Malaysia > Vietnam > Cambodia. Urban > Rural. Big difference with developed country.
- **Energy price is low.** Electricity price: Malaysia, Vietnam:8 cent/kWh, Bangkok: 13 cent/kWh, Cambodia : 21 cent /kWh and Japan: 27 cent/kWh.
- Size of housing: around 90㎡ in urban area. It is similar as Japan. However, housing size per capita is smaller than Japan. Japan: 40 m²/person, Southeast Asia: 15～28m²/person.

High consume of lighting and home appliances

High consume of cooking

High consume of electricity



Penetration ratio of home appliances and ways to keep cool

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- AC, Hanoi is similar as Japan. Kuala Lumpur, Bangkok and Ho Chi Minh are about 50%. Cambodia and Rural area is low. 3 fans in each family.
- Hardly use AC during day time. Almost people take cool by ventilation and fan. Over half households use AC on night time.
- Setting temperature of AC is over 25 ℃ (Japan is 26.4℃)
- **Cooling has been used sparingly, but do not feel the discomfort.** From 50 to 70% people feel comfortable.
- Usage time of AC is 7-13 hours in urban area.

Cooling will increase significantly

"Cooling is culture" would be misunderstanding.

- Flat panel TV is rapidly spread. Japan, Malaysia and Vietnam > Thailand and Cambodia. CRT-type TV still remain in Thailand and Cambodia.
- Penetration ratio of fridge is almost 100% except Cambodia. Capacity of fridge is over 200 litter (grow in size).
- Penetration ratio of rice cooker is as same in Japan.
- PC, urban area of Vietnam is similar as Japan.
- One cellular phone in every one.

Factor of high energy consumption

Pay attention of future growth of fridge's capacity

Almost same level as developed countries

Development of BELDA database

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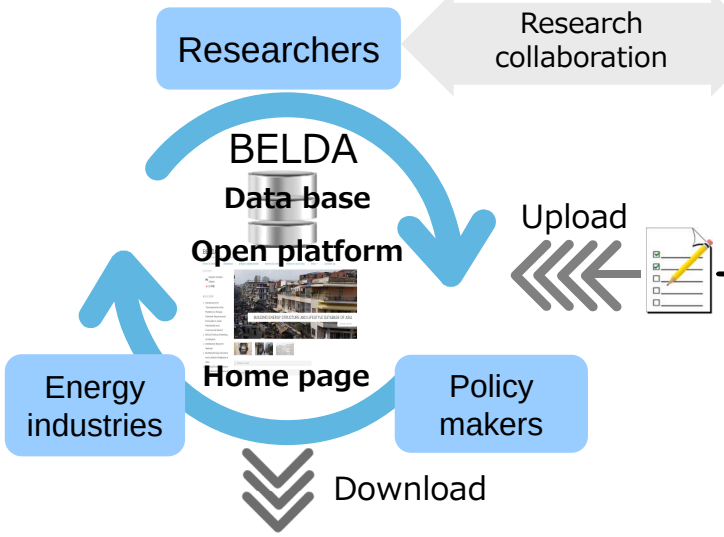
BELDA: **B**uilding **E**nergy structure and **L**ifestyle **D**atabase of **A**sia



- Simple & cross tabulation of field survey results
- Macro data / Meteorological data
- Existing paper and survey data
- Standard questionnaire sheet

Results of field survey since 2015

- Household Energy Consumption (2015)
- Detailed Interview survey for lifestyle (2016)
- Electricity measurement survey (2016-2017)

- Macro data
- Meteorological data
- Existing paper and survey data
- Standard questionnaire sheet

Data input / upload

- Registered users can input data on questionnaire sheet and compare with the results of the database.
- Registered users can upload their survey results.

BELDA Home Page
(Building Energy structure and Lifestyle Database of Asia)

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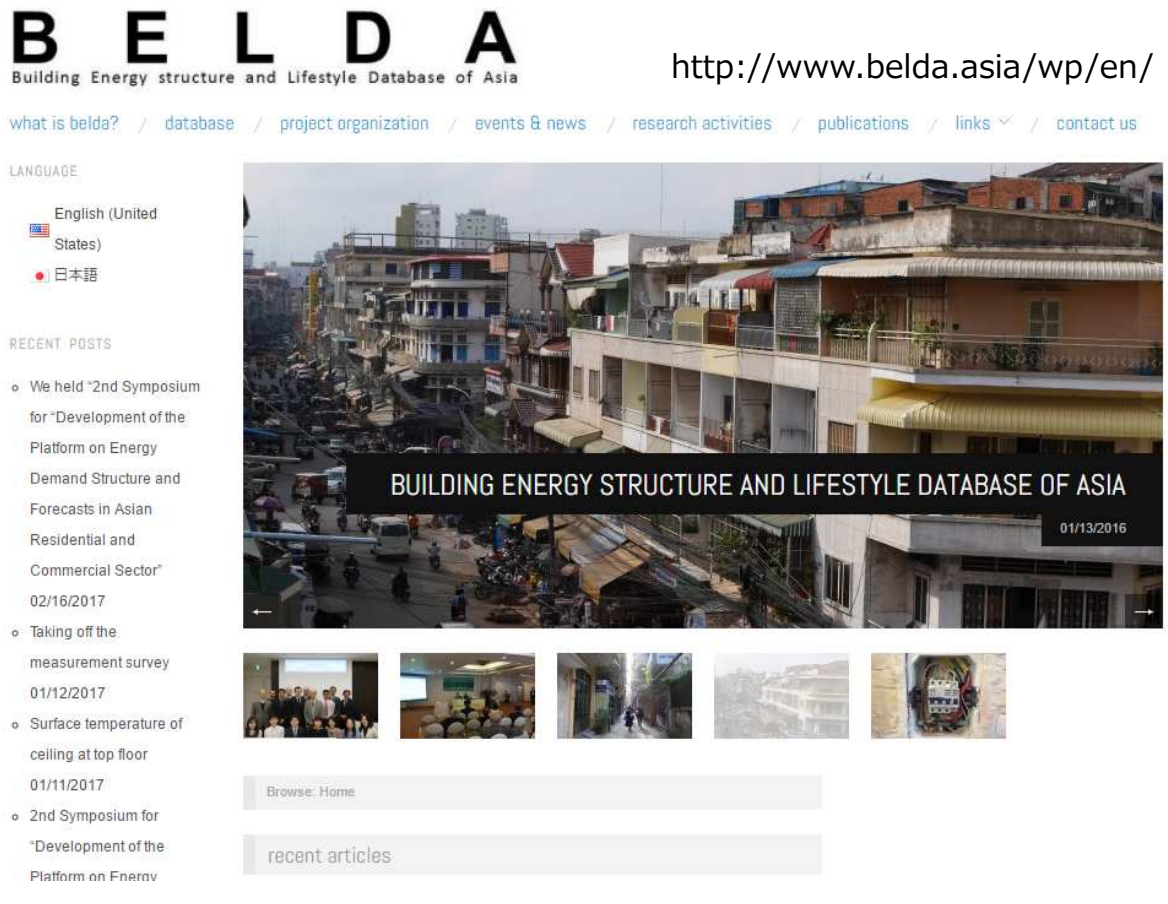

Energy Efficiency Policy issues in Southeast Asian countries

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- Possibilities of implementing energy efficiency measures vary depending on the state of a country's public policy systems and on energy prices.
- EE policy is depending on;
  - Economic development has advanced in the following order: Malaysia, Thailand, Vietnam, and Cambodia.
  - Income for a typical family is at the same level in Malaysia and Thailand, followed by Vietnam and Cambodia, and residential energy use is at the same level in Malaysia, Thailand, and Vietnam.
- Energy efficiency policies greatly differs.
  - Cambodia: no energy efficiency law
  - Vietnam: the Law on Energy Saving and Efficiency effected in 2011
  - Thailand: Energy Conservation and Promotion Act formulated in 1992
  - Malaysia: Malaysia plan 2015 (revised every 5 years)

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- Policies first target large-scale industrial and commercial facilities.
- Household Energy Efficiency measures is behind depending on welfare policy.
- Generally, energy conservation policies for residential sector consisted:
  - energy efficiency standards for housing and equipment
  - labeling system
  - subsidies and low-interest loans to promote high-efficiency equipment
  - various information is provided in order to stimulate consumer awareness and demand in the market

	Malaysia	Thailand	Vietnam	Cambodia
Electricity price	8 US¢/kWh	13 US¢/kWh	8 US¢/kWh	21 US¢/kWh
Energy Efficiency standard on Buildings	Voluntary Guideline	Mandated more than 2,000 square meters	Mandated more than 2,000 square meters	No
MEPS	5 items	MEPS:7 items HEPS:8 items (voluntary)	7 items	No
Labeling	5 items（planning add 6 items）	27 items (include 19 items of home appliances）	17 items (include 10 items of home appliance）	Under contemplation

Note, HEPS: High Energy Performance Standard (top 20% point)

Recent distinctive policy change

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- In Thailand, Energy Efficiency Development Plan 2015-2036.
  - Mandatory measures in the plan include:
    - enforcement of energy efficiency standards in designated factories and buildings
    - enforcement of energy labeling on equipment/appliances
    - introduction of Energy Efficiency Resource Standard
  - Voluntary measures include:
    - supporting financial tools to hasten change to high efficiency equipment
    - promoting greater use of LED by price mechanism
  - Complementary measures, including support for:
    - human resource development for energy conservation
    - creation of public awareness and behavioral change
- In Malaysia, the 11th Malaysia Plan (2016-2020) includes measures such as formulation of a comprehensive **demand side management master plan** and encouraging its spread.

Conclusion and recommendations

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- **We started a field survey of actual conditions of residential energy use in urban areas and outlying farming villages in Malaysia, Thailand, Vietnam, and Cambodia from 2015.**
  - ✓ Electricity use or demand for space cooling, lighting and plug loads, and cooking by urban households in Southeast Asia is already at the same levels as developed countries, including Japan.
  - ✓ Cars in Malaysia and Thailand, and motorcycles in Vietnam and Cambodia emit large quantities of CO_2.
- **Although the huge population, residential energy efficiency measures lag behind.**
  - ✓ Electricity prices are kept low for people's welfare. And energy efficiency policies are mainly implemented to target industry and large commercial buildings.
  - ✓ The population size of ASEAN 10 member countries is 637 Million.
- **It is important to early adoption of the newest technologies from around the world and in-depth energy efficiency policies are needed in order to decrease or stem future increase on residential energy use.**
  - ✓ Implement stronger mandatory energy efficiency standard such as Japan's Top Runner standards.
  - ✓ Accelerate the introduction of smart appliances, HEMS, highly heat insulated & airtight housing and renewable energy.
- **More detailed and large scale energy survey, development of database and making policy recommendations would be required, because on there has been hardly any collection and maintenance of basic information needed in order to plan energy efficiency policy.**
  - ✓ In 2017 year we plan to build an open platform database that can be accessed freely by interested parties, and to recommend policies for each country that are produced jointly by specialists in Japan and Southeast Asian countries.

Thank you for your attention

Penetration ratio of home appliances

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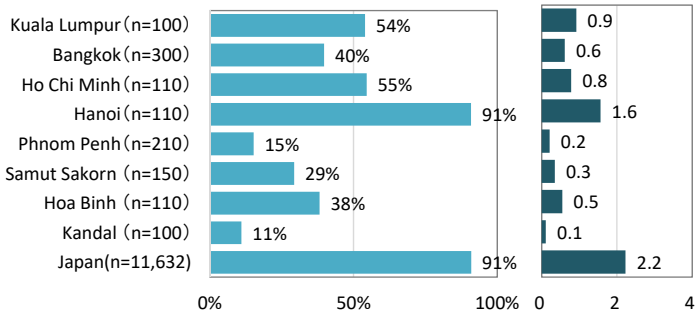
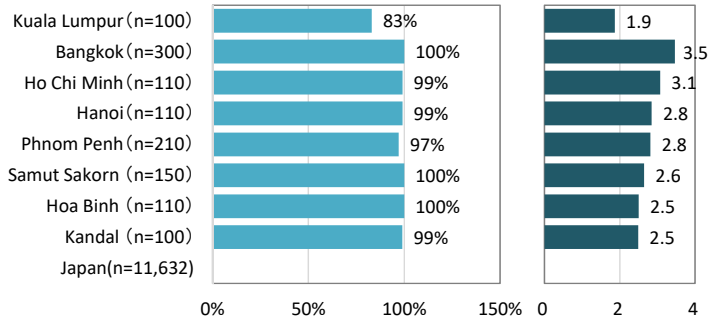
- AC, Hanoi is similar as Japan. Kuala Lumpur, Bangkok and Ho Chi Minh are about 50%. Cambodia and Rural area is low. 3 fans in each family. **Cooling will increase significantly.**

Air Conditioner <households penetration> <appliances penetration>

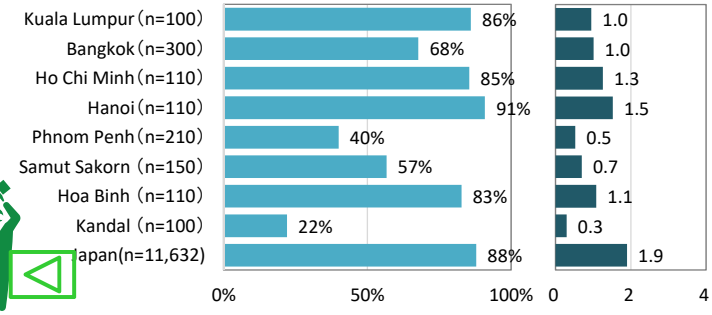


Fan <households penetration> <appliances penetration>

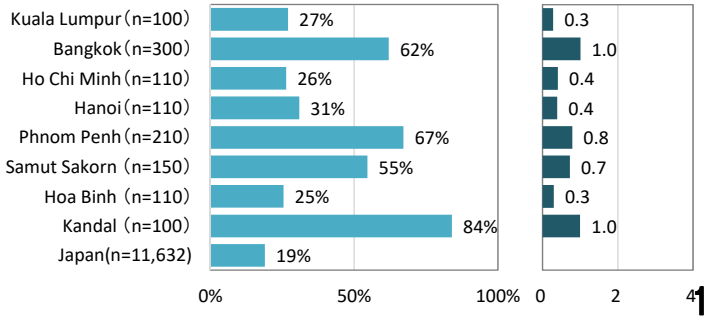


- Flat panel TV is rapidly spread. Japan, Malaysia and Vietnam > Thailand and Cambodia. CRT-type TV still remain in Thailand and Cambodia. **Factor of high energy consumption**

Flat Panel TV < households> <appliances>



CRT-type TV < households> <appliances>



Penetration ratio of home appliances

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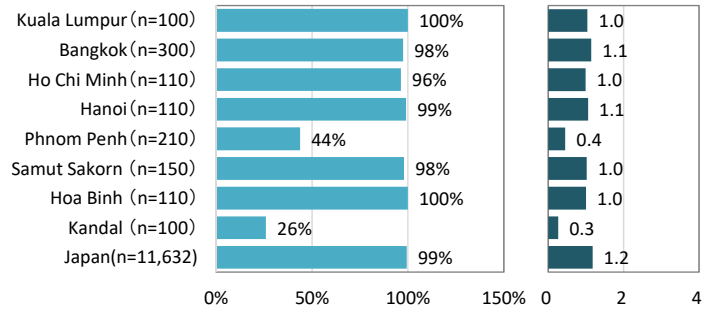
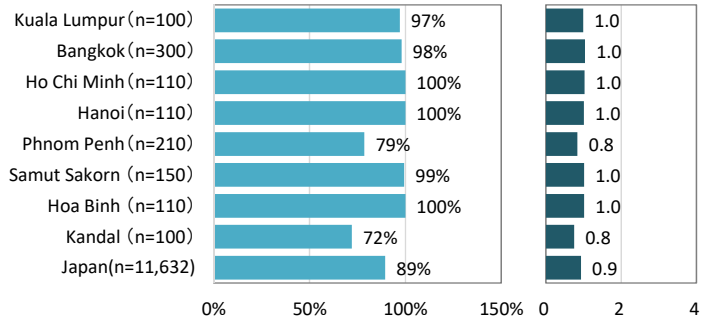
- Penetration ratio is almost 100% except Cambodia. Capacity of fridge is over 200 litter (grow in size).

Promote high efficient fridge would be required due to grow in size.

Refrigerator <households penetration> <appliances penetration>



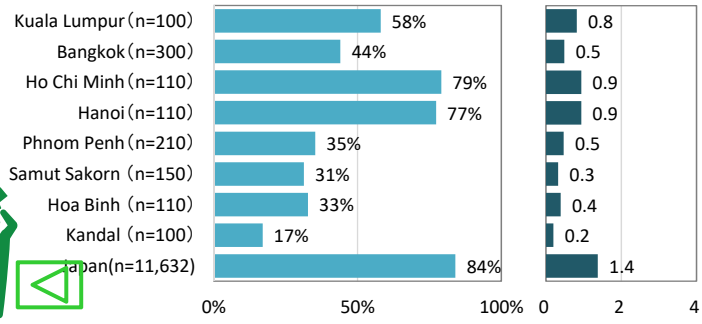
Rice cooker <households penetration> <appliances penetration>



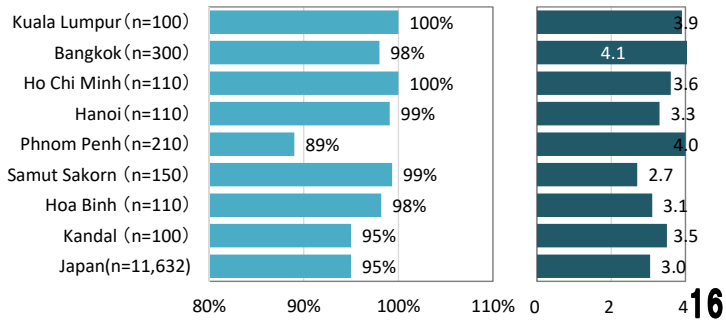
- PC, urban area of Vietnam is similar as Japan. One cellular phone in every household. Every one have it in Japan.

Pay attention of future growth

PC <households penetration> <appliances penetration>



Cellular phone <households penetration> <appliances penetration>



Ways to keep cool & Satisfaction with indoor environment (with & without AC)

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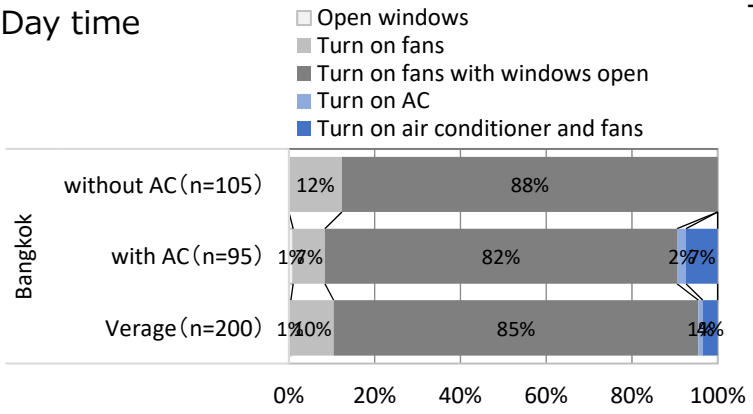
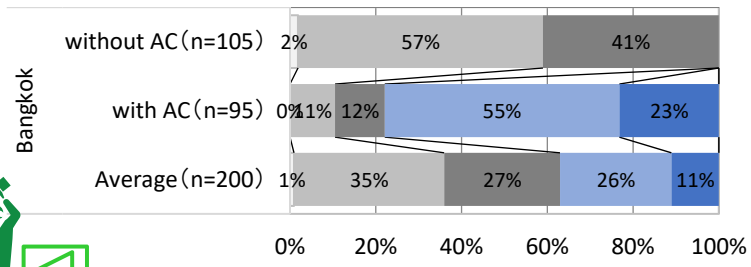
Bangkok, Thailand

Ways to keep cool

Day time

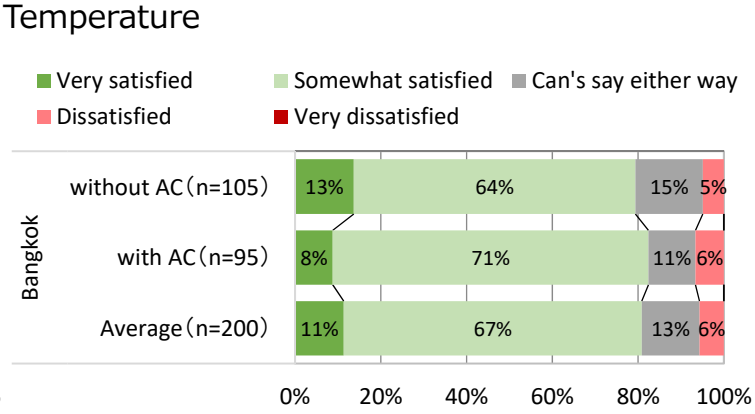


Night time

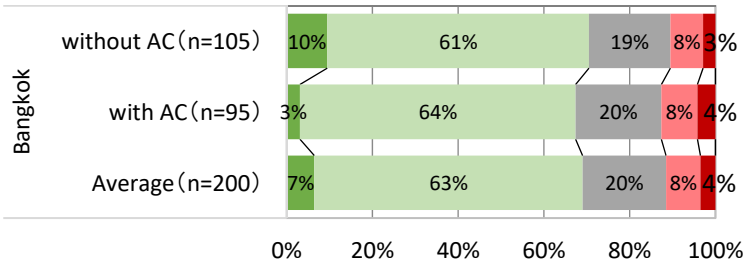


Satisfaction with indoor environment

Temperature



Humidity



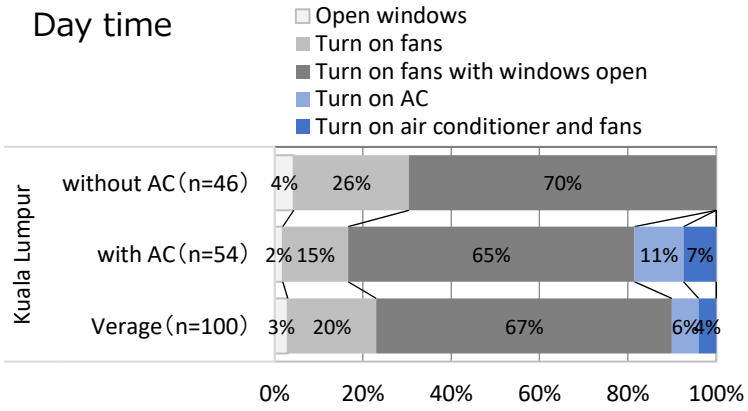
Ways to keep cool & Satisfaction with indoor environment (with & without AC)

JYUKANKYO RESEARCH INSTITUTE INC.

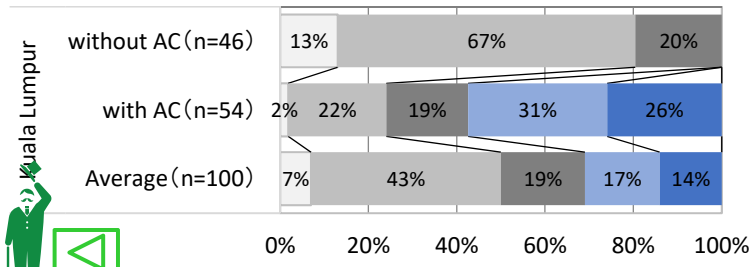
Kuala Lumpur, Malaysia

Ways to keep cool

Day time



Night time



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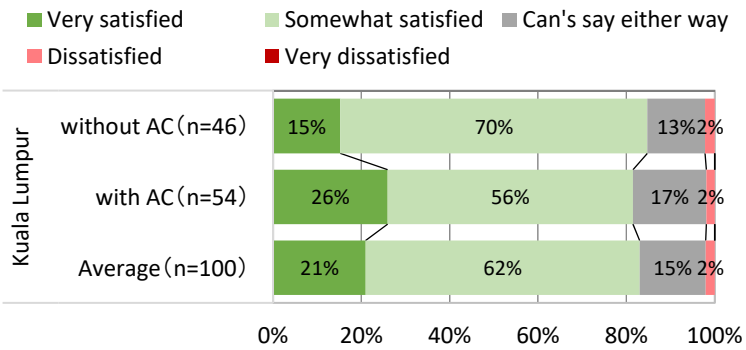

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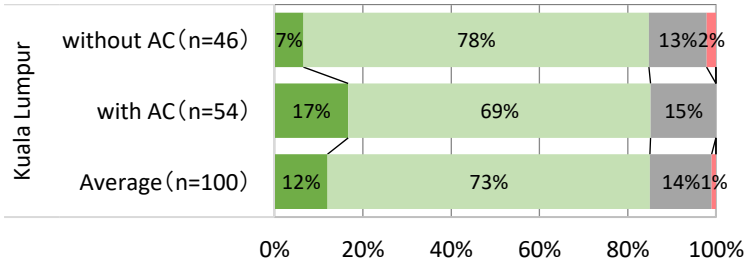

Ways to keep cool & Satisfaction with indoor environment (with & without AC)

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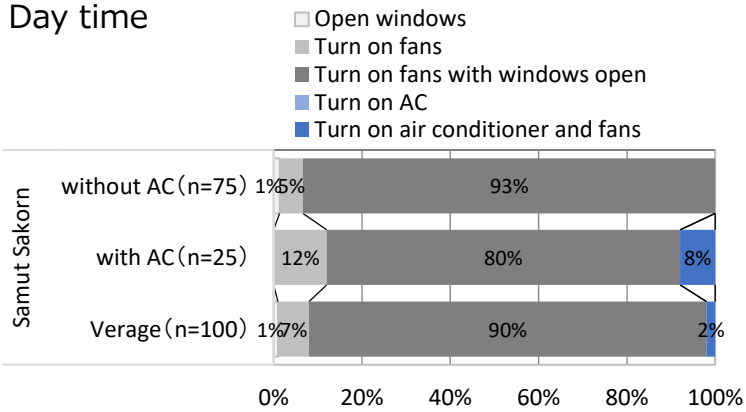
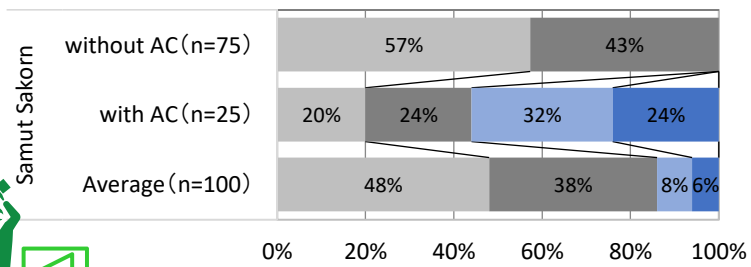
Samut Sakorn, Thailand

Ways to keep cool

Day time

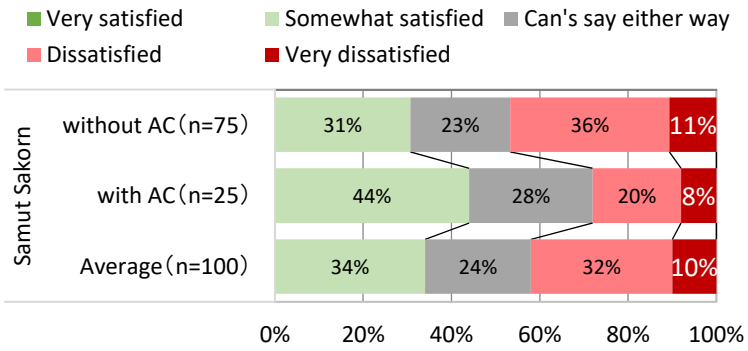


Night time



Satisfaction with indoor environment

Temperature



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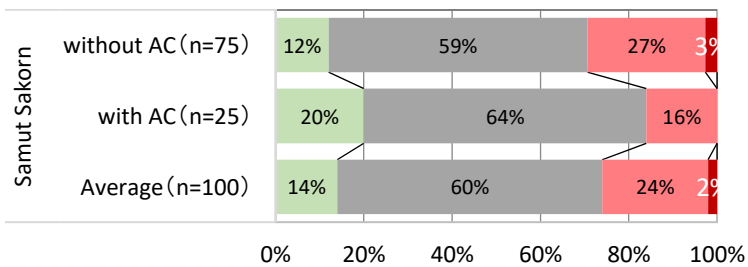

Ways to keep cool & Satisfaction with indoor environment (with & without AC)

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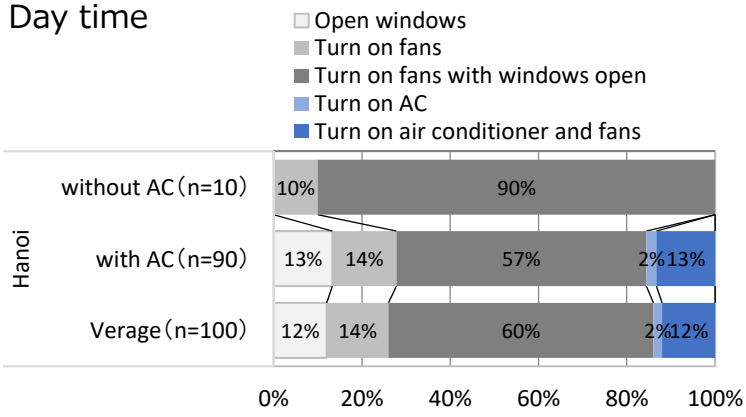
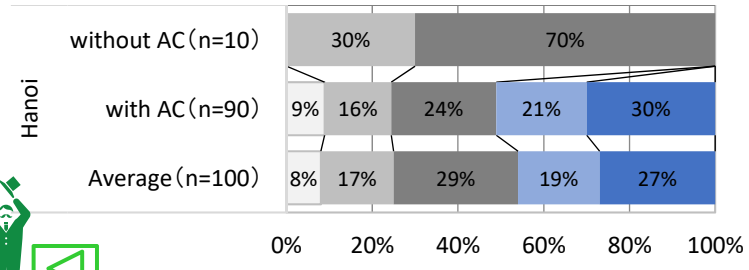
Hanoi, Vietnam

Ways to keep cool

Day time



Night time



Satisfaction with indoor environment

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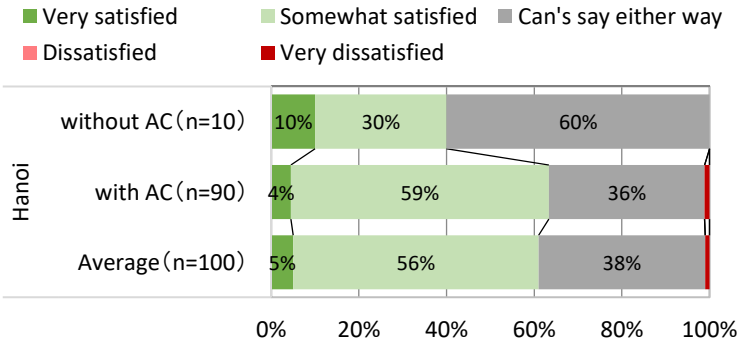

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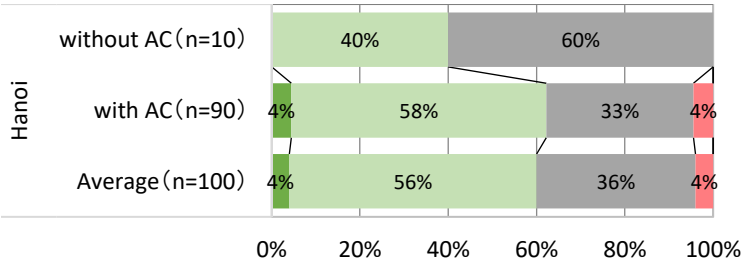


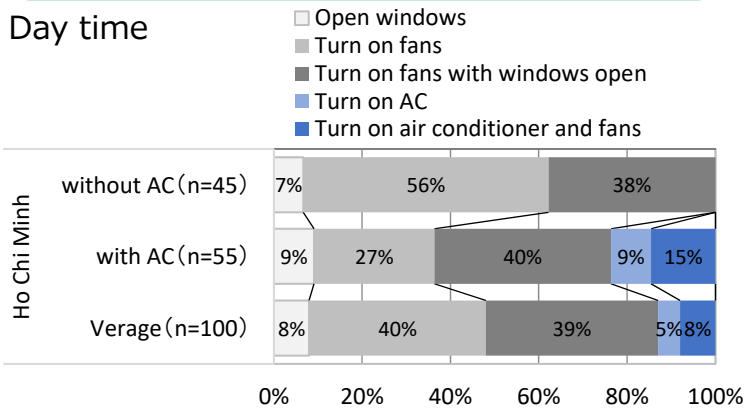
Ways to keep cool & Satisfaction with indoor environment (with & without AC)

JYUKANKYO RESEARCH INSTITUTE INC.

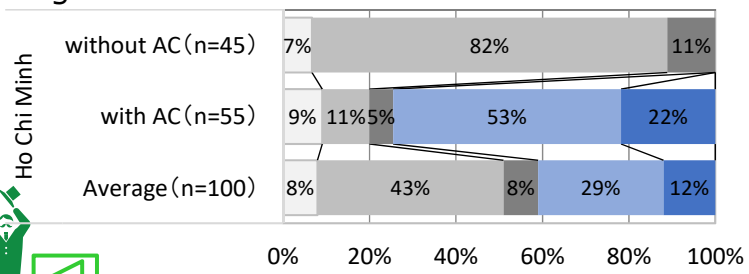
Ho Chi Minh, Vietnam

Ways to keep cool

Day time

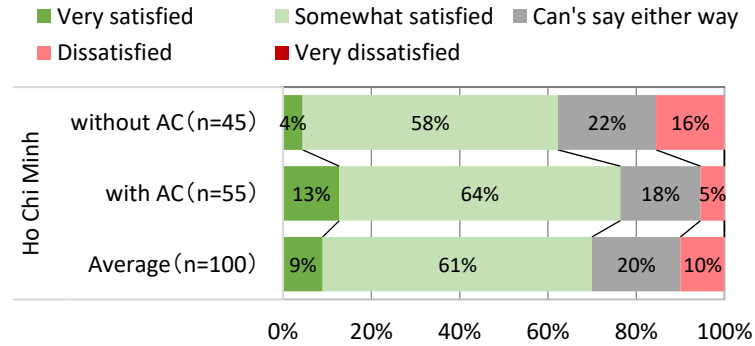


Night time

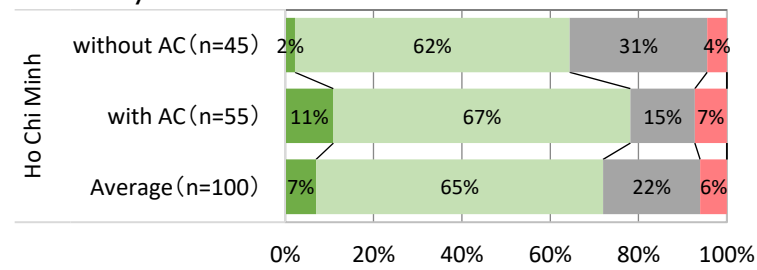


Satisfaction with indoor environment

Temperature



Humidity



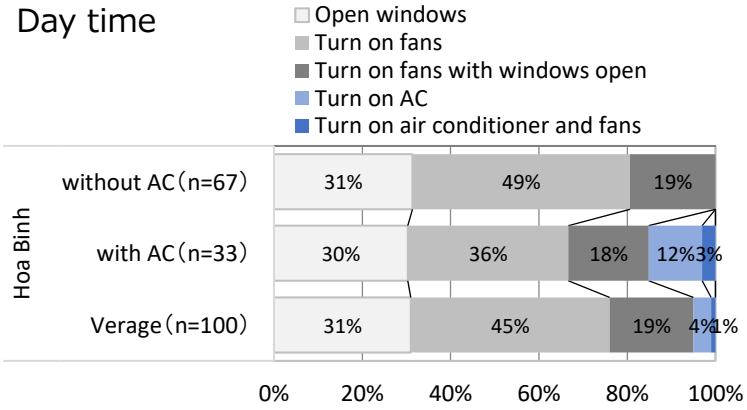
Ways to keep cool & Satisfaction with indoor environment (with & without AC)

JYUKANKYO RESEARCH INSTITUTE INC.

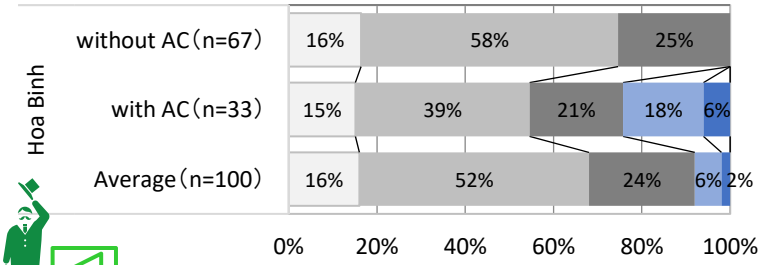
Hoa Binh, Vietnam

Ways to keep cool

Day time

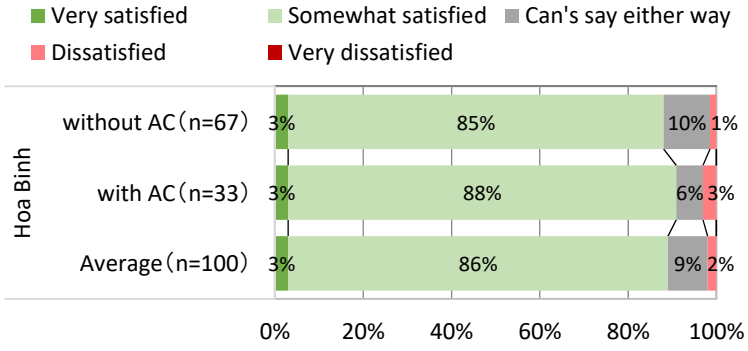


Night time

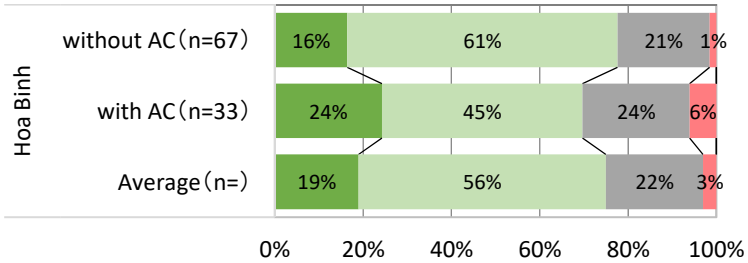


Satisfaction with indoor environment

Temperature



Humidity



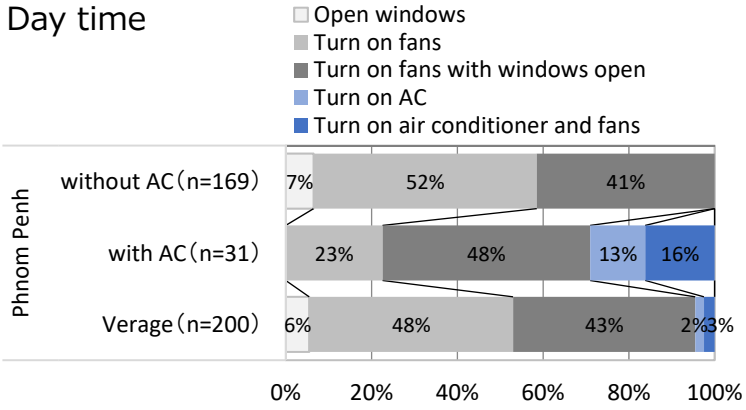
Ways to keep cool & Satisfaction with indoor environment (with & without AC)

JYUKANKYO RESEARCH INSTITUTE INC.

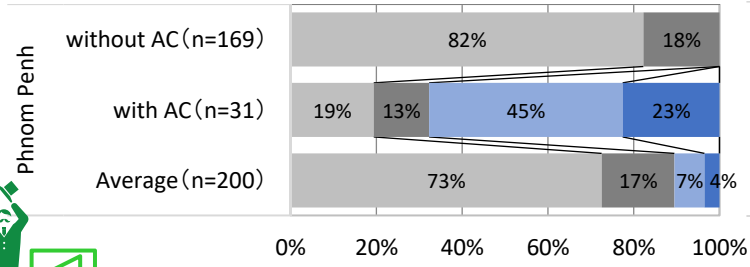
Phnom Penh, Cambodia

Ways to keep cool

Day time

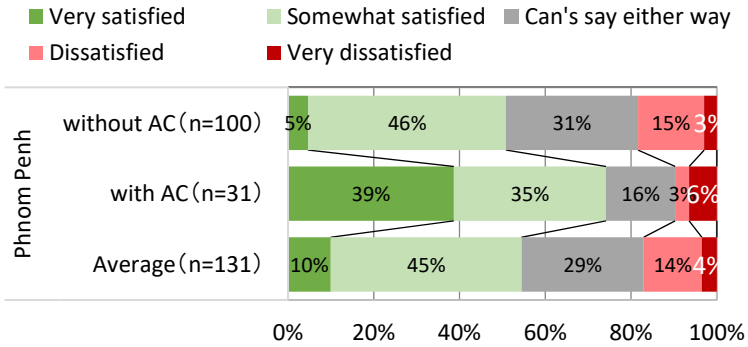


Night time

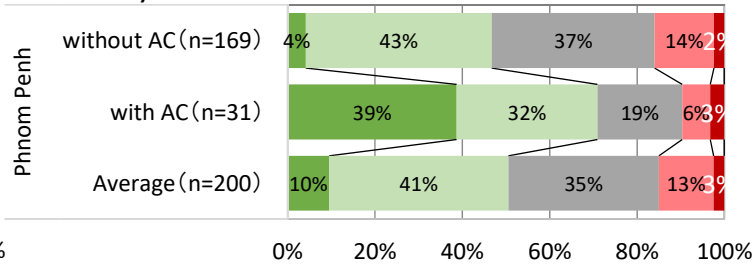


Satisfaction with indoor environment

Temperature



Humidity

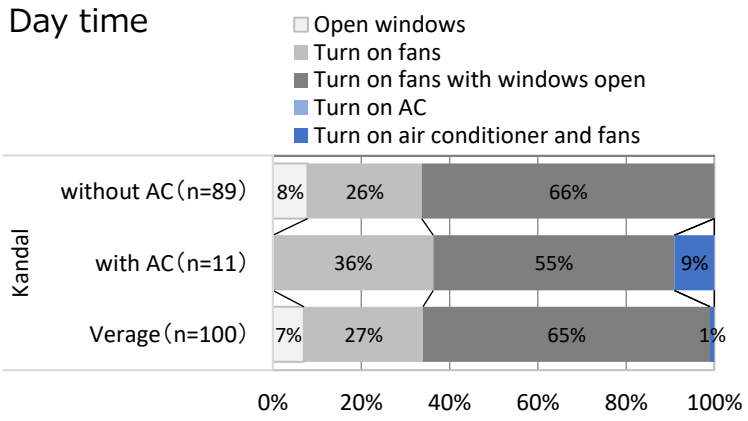


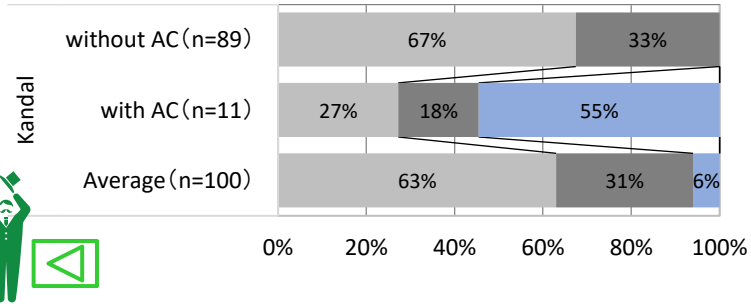
Ways to keep cool & Satisfaction with indoor environment (with & without AC)

JYUKANKYO RESEARCH INSTITUTE INC.

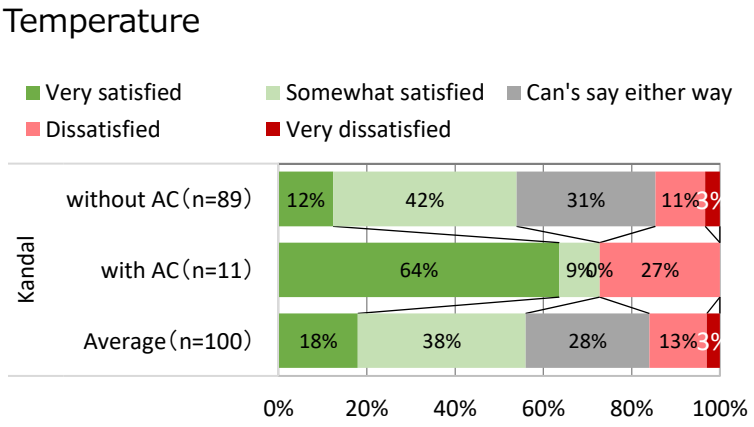
Kandal, Cambodia

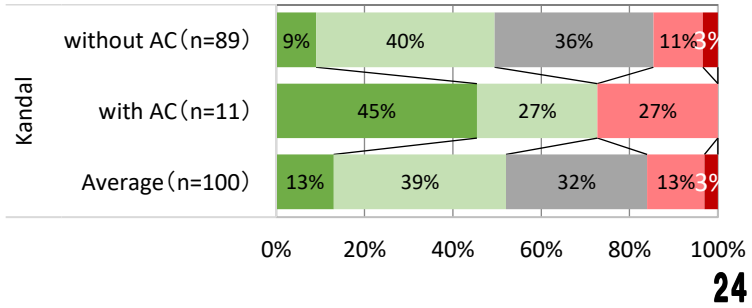
Ways to keep cool





Satisfaction with indoor environment





Hours of Use of Home Appliances

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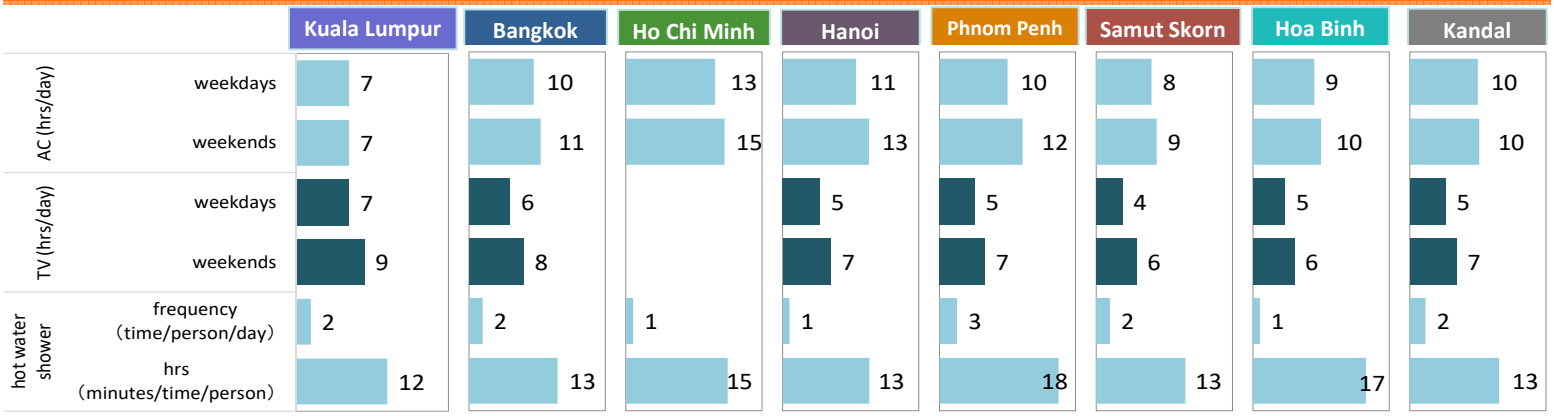

AC
Hours of AC usage
Japan : 8 hrs

TV
Average time spent watching TV
Japan: 6 hrs, USA: 5 hrs

TV & AC
Usage hours of AC & TV during weekends are 1-2 longer than during weekdays.

Hot water shower
People are taking hot water showers 1-2 times every day (under 20 minutes).

Lighting		Urban Area					Rural Area		
		Kuala Lumpur	Bangkok	Ho Chi Minh	Hanoi	Phnom Penh	Samut Sakorn	Hoa Binh	Kandal
Diffusion ratio	incandescent	3%	5%	40%	38%	5%	1%	28%	3%
	fluorescent	99%	100%	97%	97%	100%	100%	100%	100%
	LED	9%	4%	19%	27%	3%	0%	30%	0%
Usage hours	incandescent	4	3	15	4	6	1	3	4
	fluorescent	5	4	7	7	4	4	9	3
	LED	5	4	5	5	2	0	10	0

Misunderstanding of the developed countries on household energy consumption in Southeast Asia

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Consumption per capita is little lower than developed countries.

But the difference is small.